REMARKS

Claims 23-34, 37-54, 56, and 58-65 are pending in the present application. Claim 1-22, 35-36, 55, and 57 were previously canceled. Claims 23 and 46 have been amended herein. No new matter has been added. Applicants respectfully request reconsideration of the claims in view of the following remarks.

CLAIMS 23-34

Claims 23-30, 33, and 34 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over U.S. Patent Publication No. 2006/0141400 A1 (hereinafter "Hirayama") in view of U.S. Patent Publication No. 2005/0084794 A1 (hereinafter "Meagley"). Claims 31 and 32 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Hirayama in view of Meagley, and further in view of U.S. Patent Publication No. 2005/0037269 A1 (hereinafter "Levinson").

Applicants' claim 23 has been amended to recite, "immersion fluid has diffused into the photoresist layer to reach an interface between the photoresist layer and the semiconductor structure," to more clearly recite one of the distinguishing features of an embodiment of Applicants' invention.

The Office Action asserted that Hirayama disclosed all of the elements of Applicants' claim 23, except that the Office Action asserted Hirayama "fails to disclose that the photoresist layer completely diffuses with the immersion fluid prior to exposure." Office Action, page 3. The Office Action further asserts, "It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have allowed the photoresist layer and the immersion fluid to diffuse together, as suggested by Meagley, in the process of Hirayama (`400) because Meagley teaches that this provides for improved performance of the photoresist during the

patterning process." Notably, this assertion is not supported by the Office Action and it overstates the disclosure of Meagley.

Initially, it should be noted what exactly Meagley discloses. Meagley discloses "methods and compositions for providing photoresists with improved liquid-contact properties." Meagley, Abstract. Meagley asserts that additives that are soluble in the liquid may be added to the photoresist *to improve the liquid-contact properties*. Meagley, paragraph [0037]. The additives dissolve into the liquid, providing improved performance of the photoresist. *Id.*

Thus, Meagley is only concerned with the contact itself between the photoresist and the liquid. There is absolutely no disclosure in Meagley regarding the diffusion of the immersion fluid into the photoresist until the immersion fluid reaches an interface between the photoresist layer and the semiconductor structure. "In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious." MPEP § 2142.02 (citations omitted). In this case, given that Meagley is only concerned with the interface between the immersion fluid and the photoresist, the question is whether or not it would have been obvious to expose the photoresist "*after* the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure." Clearly, the question to that answer is that it would not have been obvious given the disclosure of Meagley.

In fact, the only suggestion regarding waiting to begin an exposure process until the immersion fluid has diffused into the photoresist to the interface between the photoresist and the underlying layer is from Applicants' own specification. Applicants' specification explains that one of the benefits of waiting until the photoresist layer becomes completely diffused is to

ensure uniformity. As explained in Applicants' specification, lithographic exposure performed by a step-and-expose scheme usually proceeds in a raster scan manner. Because of the time it takes to perform this process, the photoresist may have swollen to different thicknesses when processing different regions of the same wafer. As a result, different regions of the same wafer are not processed consistently and uniformly. *See, e.g.,* Applicants' specification, paragraphs [0036]-[0037].

As stated by the MPEP, "impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art." MPEP § 2142. Applicants respectfully assert that the Examiner is clearly using impermissible hindsight in asserting Applicants' claim 23 that requires exposure of the photoresist "after the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure" is obvious in view of a reference whose *sole concern* is the interface between the photoresist and the immersion fluid. Diffusion of the immersion fluid into the photoresist to the point that the immersion fluid reaches the interface between the photoresist and the underlying layer is completely unnecessary to the contact between the immersion fluid and the photoresist layer.

Furthermore, it should be clearly understood that there is absolutely no disclosure regarding waiting "*until after* the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure" before directing optical energy to the photoresist (*e.g.*, exposing the photoresist). As stated above, Meagley is only concerned with improving the contact between the photoresist and the immersion fluid. As such, Meagley fails to teach or suggest *waiting until* the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure

before directing optical energy to the photoresist (*e.g.*, exposing the photoresist) as recited in Applicants' claim 23.

In response to similar arguments, the Office Action acknowledged that Meagley "does not state that the photoresist is completely or substantially diffused with the immersion fluid, it would be obvious that this would happen if the two were to sit for a certain period of time. It would also be obvious that if the two were not diffused completely with one another then this would result in an uneven photoresist film being formed. Therefore, one of ordinary skill in the art would assume that the immersion fluid and resist of Meagley are diffused completely with one another prior to the exposure so that a uniform film is formed and an accurate exposure is performed." Office Action, pages 11 and 12. In doing so, it is clear that the Examiner is using impressible hindsight as this is taken directly from Applicants' own specification. *See, e.g.*, Applicants' Specification, paragraphs [0036] and [0037].

"However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art." MPEP § 2142. As noted above, the only facts that can be gleaned from Meagley is that one could include additives in the photoresist to improve the contact between immersion fluid and the photoresist. There is absolutely no disclosure in Meagley to wait until "after the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure" before exposing the photoresist. Furthermore, given that Meagley is only concerned with the contact between the photoresist layer and the immersion fluid, there is simply no reason to modify Meagley as suggested by the Office Action.

In one sense it appears that the Office Action is asserting that the recited elements of Applicants' claim 23 are inherent in Meagley, but this is incorrect as well. "The fact that a

certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." MPEP § 2112 (citations omitted). "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" *Id.* (citations omitted). Furthermore, "[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Id.* (citations omitted).

In this case, it is clear that it is not an inherent feature of Meagley that the exposure of the photoresist is not performed until "after the immersion fluid has diffused into the photoresist to reach an interface between the photoresist layer and the semiconductor structure." The exposure of Meagley could easily be started upon immersion of the wafer into the immersion fluid.

In summary, Applicants note that Applicants' claim 23 requires two conditions to be met: (1) "the immersion fluid has diffused into the photoresist layer to reach an interface between the photoresist layer and the semiconductor structure"; and (2) the "directing [of] optical energy through the immersion fluid and onto the photoresist layer" not be performed until the immersion fluid has diffused into the photoresist layer. The Office Action acknowledges that the cited references fail to teach either of these conditions, yet the Office Action asserts that both of these conditions are obvious in light of a reference whose sole concern is the interface between the immersion fluid and the photoresist layer. For the reasons discussed above, Applicants disagree and assert that it is clear that the Examiner is using impermissible hindsight.

In view of the above comments, and those submitted in this case previously, Applicants respectfully request that the rejection of claim 23 be withdrawn. Claims 24-34 depend from and further limit claim 23 in a patentable sense, and accordingly, Applicants respectfully request that the rejections thereof be withdrawn as well.

CLAIMS 37-54

Claims 37-43, 46-50, and 53 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Hirayama in view of Meagley and U.S. Patent Publication No. 2005/0123863 A1 (hereinafter "Chang"). Claims 44 and 45 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Hirayama, Meagley, and Chang, and further in view of Levinson. Claims 51, 52, and 54 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Hirayama, Meagley, and Chang, and further in view of U.S. Patent No. 7,176,522 B2 (hereinafter "Cheng"). Applicants respectfully traverse these rejections.

Applicants' claim 37 recites, "the patterning not being performed until after the immersion fluid is diffused substantially throughout the photoresist layer." For at least similar reasons as those cited above with reference to claim 23, the cited references fail to teach or suggest this limitation. Accordingly, Applicants respectfully request that the rejection of claim 37 be withdrawn. Claims 38-54 depend from and further limit claim 37 in a patentable sense, and accordingly, Applicants respectfully request that the rejections thereof be withdrawn as well.

CLAIMS 56 and 58-65

Claims 56 and 58-61 have been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Chang in view of U.S. Patent Publication No. 2002/0039704 A1 (hereinafter "Din"). Claim 64 has been rejected under 35 U.S.C. § 103(a) as assertedly being unpatentable over Chang in view of Din and Meagley. Claims 62, 63, and 65 have been rejected under 35

U.S.C. § 103(a) as assertedly being unpatentable over Chang in view of Din and Hirayama. Applicants respectfully traverse these rejections.

Applicants' claim 61 recites, "*converting* only an upper portion of the photoresist layer into a treated layer," "*immersing* the semiconductor wafer in an immersion fluid *after the converting*," and "patterning the photoresist layer . . . *through the immersion fluid*." Thus, Applicants' claim 61 requires that the upper portion of the photoresist layer be converted *before* the photoresist layer is patterned.

In contrast, Din, the reference cited by the Office Action as disclosing the treating of Applicants' claim 61, treats the upper portion of the photoresist layer *after* the photoresist layer is patterned. For example, Fig. 1A of Din illustrates the photoresist layer 130 after patterning of the photoresist layer, while Fig. 1B of Din illustrates hardening of the photoresist layer 130a as the antireflective layer 120a is patterned.

Accordingly, it is clear that Din fails to disclose "converting only an upper portion of the photoresist layer into a treated layer" prior to patterning the photoresist layer as recited in Applicants' claim 61.

In view of the above remarks, Applicants respectfully request that the rejection of claim 61 be withdrawn. Claims 56, 58-60, and 62-65 depend from and further limit claim 61 in a patentable sense, and accordingly, Applicants respectfully request that the rejections thereof be withdrawn as well.

Applicants have made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Roger C. Knapp, Applicants' Attorney, at 972-732-1001, so that such issues may be resolved as expeditiously as possible. The Commissioner is hereby authorized to charge any fees that are due, or credit any overpayment, to Deposit Account No. 50-1065.

Respectfully submitted,

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